AirMISR Radiometric Data Quality

The science flights made by AirMISR in support of the CLAMS campaign on July 12, July 17, August 1, and August 2, 2001 were successful. The camera successfully slewed to all nine angle positions for most of the runs; for the MODIS glint sequences, the camera was held fixed at a 45.6 degree angle (corresponding to the MISR Bf camera). The radiometric accuracy and signal-to-noise during this mission was as good as the Science Team has reported in the literature. Individual product files contain metadata identifying dropped/corrupt lines, saturated pixels and related image quality parameters.

The radiometric calibration of AirMISR has been done using the same procedures as used to calibrate the MISR cameras; the reported radiometric calibration uncertainties are therefore the same as reported for MISR. (The exception is the camera-to-camera uncertainty, which is believed to be smaller for AirMISR, as the aircraft instrument consists of one gimballed camera). Thus, it is believed that the radiometric uncertainties are small, and the camera signal-to-noise is high.

The values quoted for the systematic component of the radiometric uncertainty, based on vicarious calibration of the instrument, in fractional units, are:

abs_sys_error 0.030
cam_sys_error 0.000
band_sys_error 0.010
pixel_sys_error 0.005

That is, the systematic component of the absolute, camera-to-camera, band-to-band, and pixel-to-pixel are given above. The pixel-to-pixel uncertainty is large enough to cause some visible striping in the imagery where the scene contrast is low and the image display is stretched to highlight small radiometric differences.

These systematic components are combined with signal-to-noise (SNR), to determine the total error uncertainties. As SNR is signal dependent, the uncertainties are likewise signal dependent. SNR, at two radiance input levels, are as follows:

SNR(equivalent-reflectance=1.0) ~ 1000
SNR(equivalent-reflectance=0.05) ~ 200

Using these, the total radiometric uncertainties can be determined:

$abs\_total\_error = sqrt(abs\_sys\_error^2 + (1/SNR)^2)$
$cam\_total\_error = sqrt(2)/SNR$
$band\_total\_error = sqrt(2)*sqrt(band\_sys\_error^2 + (1/SNR)^2)$
$pixel\_total\_error = sqrt(2)*sqrt(pixel\_sys\_error^2 + (1/SNR)^2)$

References on the radiometric calibration of AirMISR and MISR are listed in Section 8.0. Additional references are available from the MISR web site.

AirMISR Geometric Data Quality

July 12, 2001 (runs 1,2,3,4,5)

These AirMISR runs used an unusual configuration in which only a single view imaging angle of 45.6 deg was used to acquire data. There was no geometric calibration conducted prior to georectification. The assessment of the georectification error for this flight was not conducted. The expected errors can be anywhere between 200 - 3000 meters.

July 12, 2001 (runs 6,7,8,9)

These AirMISR runs were acquired over ocean surface. There was no geometric calibration for these runs and the assessment of the georectification error was not conducted. The expected errors can be anywhere between 200 - 6000 meters.

July 17, 2001 (runs 1,2,3,4,5)

These AirMISR runs used an unusual configuration in which only a single view imaging angle of 45.6 deg is used to acquire data. There was no geometric calibration conducted prior to georectification. The assessment of the georectification error for this flight was not conducted. The expected errors can be anywhere between 200 - 3000 meters.

July 17, 2001 (runs 6,7,8,9)

The geometric calibration has been performed prior to orthorectification to the UTM map projection grid. The orthorectified Landsat TM scenes (path 014 row 034) obtained through ESE Scientific Data Purchase are used to collect a set of ground control points in order to remove static errors in the camera pointing and airplane position. Using calibration results, geolocation errors of about 1000 meters for nadir view to up to 6000 meters for the most oblique views are reduced down to an average of about 200 meters regarding both absolute geolocation and coregistration between seven out of nine view angles. Errors associated with the D's camera view angles are larger, up to 1000 meters, due to our inability to identify reliable ground control points in the imagery acquired at those oblique angles.

August 1, 2001

This was a single run flight with out a specific need for geometric calibration. The expected geolocation errors may be in the range of 600 - 700 m.

August 2, 2001

This was a run over ocean area with the single ground point represented by the Chesapeake Lighthouse. The expected error for the location of the lighthouse for all nine cameras should be around 500 meters.

Feedback:

For questions or comments on the AirMISR products, contact the NASA Langley Atmospheric Science Data Center User Services Office.

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